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ABSTRACT

Theorists, researchers, and practitioners should be problem solvers, and need to integrate research findings within practical models. Given a defined instructional problem, the recommendation of an appropriate solution should be based on the realization that only prescriptive design theory emphasizes methods and presentation specifications, and that descriptive theories cannot be directly translated into instructional practice. Models derived from research and theory can be developed which consider reliability, validity, and generalizability of research findings. However, problems have occurred because many theories have been developed outside the practical world of instructional development/design; researchers have focused on studies of instructional effects rather than instructional effectiveness; theoretical contributions have been reduced by misplaced emphasis on gross media comparisons; practical research studies are scarce because of the difficulties inherent in conducting classical experimental designs within the framework of day-to-day instruction; and key limitations of various theoretical models are rarely reported. Strategies that can be employed to increase the interplay of knowledge, expertise, and technology, and that make it possible to rely on the technology of instructional design and development for providing solutions include promoting open communication, examining graduate instructional technology programs to insure that they are effective, and integrating the roles of scientists and technologists. (LMM)

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RESEARCH AND THEORY INTO INSTRUCTIONAL PRACTICE: A REALISTIC CHALLENGE OR AN IMPOSSIBLE DREAM

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To many in our profession, linking research theory with practical implementation, may appear to be an impossible dream. Practitioners are the potential "knowledge users" of research findings and theory who search for information to assist practical implementation in an instructional setting. A "knowledge user" may be likely to assert that "the only true test of value for instructional theory lies in the extent, if any, to which it improves [the end result of] instruction and student learning (Snelbecker, 1983, p. 441). Conversely, those theorists and researchers who are "knowledge producers," may tend to view research findings, principles and theories as end results" (Snelbecker, 1983, p. 440). Because of these difficult perspectives, both extremes may be skeptical of the worth or utility of linking research and practice, as suggested by Passmore's perception that "there is nothing so practical as good research" (1984, p. 24). Many "knowledge producers" may be little concerned with practical implications because of their commitment to obtain and interpret empirical findings relevant to the research. Is there as Morell suggests, a "'culture gap' between those who 'do' and those who 'find out'?" (1984, p. 7). Jackson and Kieslar (1977) have observed that most practitioners prefer to rely on experience and intuition, rather than to turn to researchers for advice. At best, there could be greater interplay between knowledge users and knowledge producers (Shoemaker, 1984).

> If disciplined inquiry using the research process should be used to find a solution to instructional problems, then it becomes necessary to reduce the separation between research and practice. "This alienation should not exist in an active, creative profession" (Passmore, 1984, p. 26).

Theorists, researchers and practitioners should consider their professional charter to be that of a problem-solver (cf. Plomp and Verhagen, 1983). As problem-solvers, we need to respond to the challenge of integrating research findings within models which may be used to meet the needs of practitioners. As knowledge producers, we need to create models which establish a dynamic balance between research, theory and practice. This problem-solving challenge is based on the premise that it is not an impossible dream for a professional in our field to answer the following questions:

1. Given a defined training/instructional need or problem, can we recommend appropriate solutions with a high degree of confidence?

2. Can we develop models derived from research and theory to help us define alternative solutions which consider:

   - o reliability,
   - o validity,
   - o generalizability of research findings?

3. Can we rely on the technology of our field to provide these solutions?

Let's look at these three questions and their implications in more depth.

1. Given a defined training/instructional need or problem, can we recommend appropriate solutions with a high degree of confidence?

Before answering this question it is important to review:

- o the difference between prescriptive and descriptive theories and the implications of this difference on finding solutions.
- o causes for difficulty in translating principles from learning theory and instructional theory into instructional design and development.

The goal of a prescriptive theory is to prescribe optimal methods of instruction (Glaser, 1976; Reigeluth, 1983; Snelbecker, 1974). This goal may be contrasted with the goal-free nature of a descriptive theory which aims to describe the processes of learning/instruction. Reigeluth (1983) has summarized the distinction between descriptive and prescriptive theories (see Figure 1). His model suggests that descriptive theories establish condition and method variables as independent variables which may interact to produce effects, i.e., instructional outcomes which are dependent variables. Descriptive instructional theory places emphasis on investigating instructional variables, i.e., how information is presented to the student. In contrast, prescriptive theories establish the desired outcomes and conditions as independent variables which may interact and be used to prescribe appropriate instructional methods. That is, descriptive theories describe outcomes and effects, whereas prescriptive theories are concerned with prescribing a model which will be optimal in reaching desired outcomes under different conditions.

The act of recommending appropriate instructional solutions implies an ability to prescribe a program of instruction. Confusion emerges when there is an expectation that a prescriptive theory and an instructional program can be derived from a descriptive theory (Landa, 1983). As Landa explained, a prescriptive theory and program of instruction cannot be derived directly from a descriptive theory.

> Suppose, for example, that a descriptive learning theory says that if a person better understands a text, then he or she remembers it more easily.

> (Or: In order to more easily memorize the text, it is important to better understand it.) From this seems to follow a prescriptive instructional rule: In order for a learner to better memorize the text, it is necessary (or sufficient) to teach him or her how to understand it (or bring him or her to understanding it). This derived prescriptive instructional proposition is not, however, completely true and comprehensive. Of course, in order to secure that a learner memorizes a text better, it is important to make sure that he or she understands it or to teach him or her how to understand it. But understanding is just one of the conditions leading to better memorizing, and to secure (or teach) the understanding is not sufficient for gaining the best results in memorization. Other factors not mentioned in these propositions of learning theory (both descriptive and presciptive) should be taken into account. They are stated in other propositions of a learning theory (if it is complete). But the learning theory does not tell anything about which of its propositions should be taken into account and combined (and precisely how combined) in order to state an effective prescriptive instructional proposition (Landa, 1983, pp. 65-66).

A further confusion may emerge when learning theory and instructional design theory are confused. As Reigeluth, Bunderson and Merrill (1982) have pointed out, prescriptive learning theory is not synonymous with prescriptive instructional design theory. Because theory of instructional design focuses on methods of instruction it is relatively easy to apply in instructional/training settings. However, learning theory is more difficult to apply, because it focuses on the learning process and conditions of learning for which instruction must still be developed.

A final point of confusion often occurs when the instructional design "blueprint" is confused with the expectations for an instructional developmental model. Instructional-design blueprints "indicate what the instruction should be like, whereas development models indicate how to make it that way.... There is a very real important difference" (Reigeluth, 1983, p. 24).

In summary, given a defined training/instructional need or problem, the recommendation of an appropriate solution needs to be based on the realization that:

- only prescriptive instructional design theory places emphasis on methods and how information should be presented to a student.
- descriptive theories can not be directly translated into instructional practice.

2. Can we develop models derived from research and theory to help us define alternative solutions which consider:

   - o reliability,
   - o validity,
   - o generalizability of research findings?

In the past, many researchers have interpreted the discovery of psychological effects to be a complete research finding (Salomon, 1974). Although this is appropriate in many fields, instructional research carries the added criterion of effectiveness (Salomon, 1974). The criterion of effectiveness is evident in the teaching of most educational research methodology courses in which students are cautioned to contemplate upon proposed findings and to ask, "So what?" This question goes beyond simple justification of the purpose of the study. By asking "So what?" a researcher questions the value of the effects as they relate to total instructional effectiveness. This added criterion of effectiveness in instructional research suggests that it is not enough for a problem-solver/researcher to study generalized effects alone (Salomon, 1974).

When considering the development of effective models from research theories several realities need to be addressed:

- o Many theories have been developed outside the practical world of instructional development/design (Diamond, 1978).

- o Researchers have tended to focus on studies of instructional "effects" rather than instructional "effectiveness" (Salomon, 1974, 1979).

- o Theoretical contributions have been reduced by misplaced emphasis on gross media comparisons ("Research with media") as opposed to "Research on media" (Salomon & Clark, 1977). Research with media, e.g., TV versus film comparisons, have failed to provide knowledge about a specific medium, and the way that individual learners learn from the presentations.

- o Practical research studies are scarce because of the difficulties in conducting classical experimental designs within the framework of day-to-day instruction (Clark, 1971; Diamond, 1978).

- o Key limitations and problems associated with various theoretical models are rarely reported (Diamond, 1978). As Diamond pointed out probably we all have had the experience of discussing a model, theory, or program with its instigator only to discover major limitations which were omitted from what we had read or heard.

It is important to remember that research techniques designed to establish cause and effect relationships may not be suitable for studies of effectiveness. Research designs appropriate for laboratory-oriented research may impose "artificial and unrealistic constraints on decision-oriented (situation specific) questions" (Heinich, 1984, p. 84). The quasi-experimental approaches described by Campbell and Stanley (1963) are of growing importance to researchers in our field. Campbell

and Stanley have stressed that when full-experimental control is lacking as in a quasi-experimental design, it is crucial for the researcher to consider those variables which the research fails to control. They recommend that the reseacher actually seeks out such threats to validity, so that there is a sound awareness of potential competing interpretation of the data. Confidence in the internal validity, reliability and generalizability of the research can be maintained. Diamond (1978), Heinich (1984), and others are calling for a movement away from experimental to more naturalistic, field-based studies. "I am not implying less rigorous study. In my view, a naturalistic study must be more disciplined, more perceptive, if less mathematical, than an experimental study" (Heinich, 1984, p. 85).

The writings of Gagne (1977), Snow (1970), Kaufman (1983), Merrill (1977), and Salomon (1979), to name a few, have attempted to provide insight for practitioners who in their day-to-day experience do not have time to investigate relevant research before implementing a solution to an instructional need/problem. A common perception is prevalent throughout these writings; that is, there is a need to derive principles, theoretical models, skeleton hypotheses as a basis for integrating research and practice.

Before the "knowledge user"/practitioner can apply effective instructional strategies, the "knowledge producer" must derive and validate prescriptive principles, and construct and test prescriptive theories and models of instruction. Reigeluth (1983) has extended Snow's (1971) theory-construction procedures. In Reigeluth's procedure the following steps were proposed:

Step 1: Develop formative hypothesis about instructional design on the basis of experience, intuition, and/or logic.

Step 2: Develop a taxonomy of variables related to instructional design. "It is usually best to start with a clear description of desired outcomes. Then, generate as many methods as you can for achieving those outcomes. Finally, identify different conditions that will influence which methods will work best" (1983, p. 31). In other words, this step involves identifying, describing and classifying variables that may impact instructional design theory.

Step 3: Derive principles of instructional design. This step relies heavily on experience, intuition systematic thought to postulate the principles and upon empirical research to test them.

The principles postulated in this step usually define cause and effect relationships among variables identified in the previous step which relate to formative hypotheses developed in Step 1.

Step 4: Develop models and theories of instructional design. As Reigeluth recommended "theories can be developed by integrating strategy components into models that are likely to be optimal for different sets of conditions and outcomes....the methodology is very different than that for deriving and testing principles. Stepwise multiple regression can be used to rank order the contribution of each strategy component to the instructional outcomes, when adjusted for all strategy components that contribute more" (1983, p. 31).

Reigeluth noted that the order of the preceding steps may change. For example, Steps 3 and 4 could be interchanged depending on whether an inductive or deductive approach was used. This procedure may form a promising basis for future development of models derived from research and theory.

3. Can we rely on the technology of our field to provide these solutions?

In order to find solutions to instructional problems, there must be a phase which emphasizes data collection and data analysis. The results of the analysis phase needs to be integrated into a subsequent phase of ongoing synthesis to facilitate development of a comprehensive theory (Martin & Driscoll, 1984; Reigeluth, 1983). We have an ever growing need to reap the benefit of knowledge produced within our field. We may meet this need through the use of synthesis and the recognition of commonalities across different philosophical perspectives. We need to meet the further challenge of how to reconcile seemingly opposing theories. As Clark noted:

> There are at least three factors that provide a very encouraging context for focus and integration of theory: First, there are simply too many design models with overlapping purposes, variables and predictions; second, to those who have surveyed many of these models there is clear if implicit agreement between many researchers on the type of variables that are important for a unified design theory (e.g., instructional methods, tasks and constraints such as individual differences); and finally, instructional psychology is ripe for a major attempt to reconcile behavioral and cognitive approaches to instruction and learning (1984, p. 120).

In a recent monograph, Reigeluth (1983) has incorporated concise descriptions of models provided by Merrill, Scandura, Gropper, Aronson and Briggs and other instructional design theorists. His work represents a timely contribution to a growing trend of attempts to synthesize information about instruction and learning into prescriptive models.

From the work of these authors and others, it is evident that knowledge, expertise and technology is available to those who wish to meet the challenge of integrating research and practice. What strategies should we employ to increase such interplay so that we can rely on the technology of our field to provide solutions? The following suggestions may provide appropriate direction:

1. Open Communications

"Knowledge producers" need to promote open communications by:

- developing formal and informal networks for an exchange of information across groups, i.e., psychologists, instructional technologists, designers, training developers, researchers, instructors, and administrators.

- o establishing convention forums for work in progress, as well as completed studies (cf. Heinich, 1984).

- o reporting results of appropriate studies in education and training journals as well as journals dedicated to research.

- o promoting forums for "knowledge users" to express their problems (cf. Passmore, 1984).

- o advocating the use of extensive analysis at the working level, only when there will be an increased return on the investment of time and resources (e.g. to determine why certain learners aren't learning versus across the board implementation) (Diamond, 1978).

- o using professional judgement to avoid excessive discussion of complex models and theories with client-practitioners. As Diamond (1978) pointed out, practitioners need to understand the design process yet usually they are not interested in jargon, models, or theory

  People whose role is primarily one of producing information are likely to be rich in only one of the various types of power. That type of power is expertise, and it must be carefully used to good advantage in establishing one's credibility, in opening up communication channels, and in garnering influence (Morell, 1984, p. 7).

2. Examine graduate instructional technology programs to ensure that the following needs are met:

   - o an emphasis on systematic problem-solving (cf. Plomp & Verhagen, 1983). With these skills, the graduate may be able to resolve the conflict between a knowledge producer's view of "what should be done," the practitioner's perspective of "what can be done," given real world constraints (e.g., time, budget, resource and informational limitations; organizational goals; biases and needs of decision-makers; incentives for change) (cf. Diamond, 1978; Morell, 1984).

   - o a climate of acceptance for dissertations based on naturalistic research methods (Heinich, 1984).

   - o exposure to successful models which have been integrated and used by practitioners (e.g., models developed by military research organizations).

   - o training to evaluate, compare and contrast the strengths and weaknesses of various theories, so that the graduate is able to defend a specified model, theory or process. That is, the graduate not only needs to understand the rationale behind the theory, but also the implications for application in their future work settings (Diamond, 1978).

- encouraging research and practice which seeks alternative ways to prevent instructional problems from occurring, as well as strategies to provide solutions for existing problems (cf. Davies, 1978).

- development of graduates who are skilled practitioners and reflective scholars (Heinrich, 1978).

3. Integrate the roles of those in our field.

As Reigeluth, Bunderson and Merrill (1982) advocated, we need to integrate the efforts of the "scientist" who discovers principles, the "technologists" who use these principles to develop procedures and heuristics, and the practitioner who uses these procedures and heuristics to develop instructional materials. This may be achieved by:

- placing research and development activities within the same organizational framework. Shoemaker (1984) proposed that these professionals be placed in close physical proximity to facilitate increased transfer of information.

Where do we go from here?

Ivor Davies (1978) has challenged our field to assert ourselves and begin a new growth pattern based upon opening up the possibilities available to use through aiming for effectiveness in all we do. As the result of many decades of research, we have accumulated a vast amount of information relating to theories of learning and instruction. It is reminiscent of a giant jigsaw puzzle with each piece of research information equivalent to each piece of the puzzle. The need for solutions to instructional/training problems requires that we as professionals are not only concerned with the discovery of more pieces, but also stress attempts to integrate these findings. As problem-solvers, we need to assemble the existing pieces within a picture which represents a macro-view of the science of instruction. Our challenge is to find "the picture on the lid" which will integrate the efforts of all professionals--the scientist and the technologist and the practitioner. This is our realistic challenge not our impossible dream!

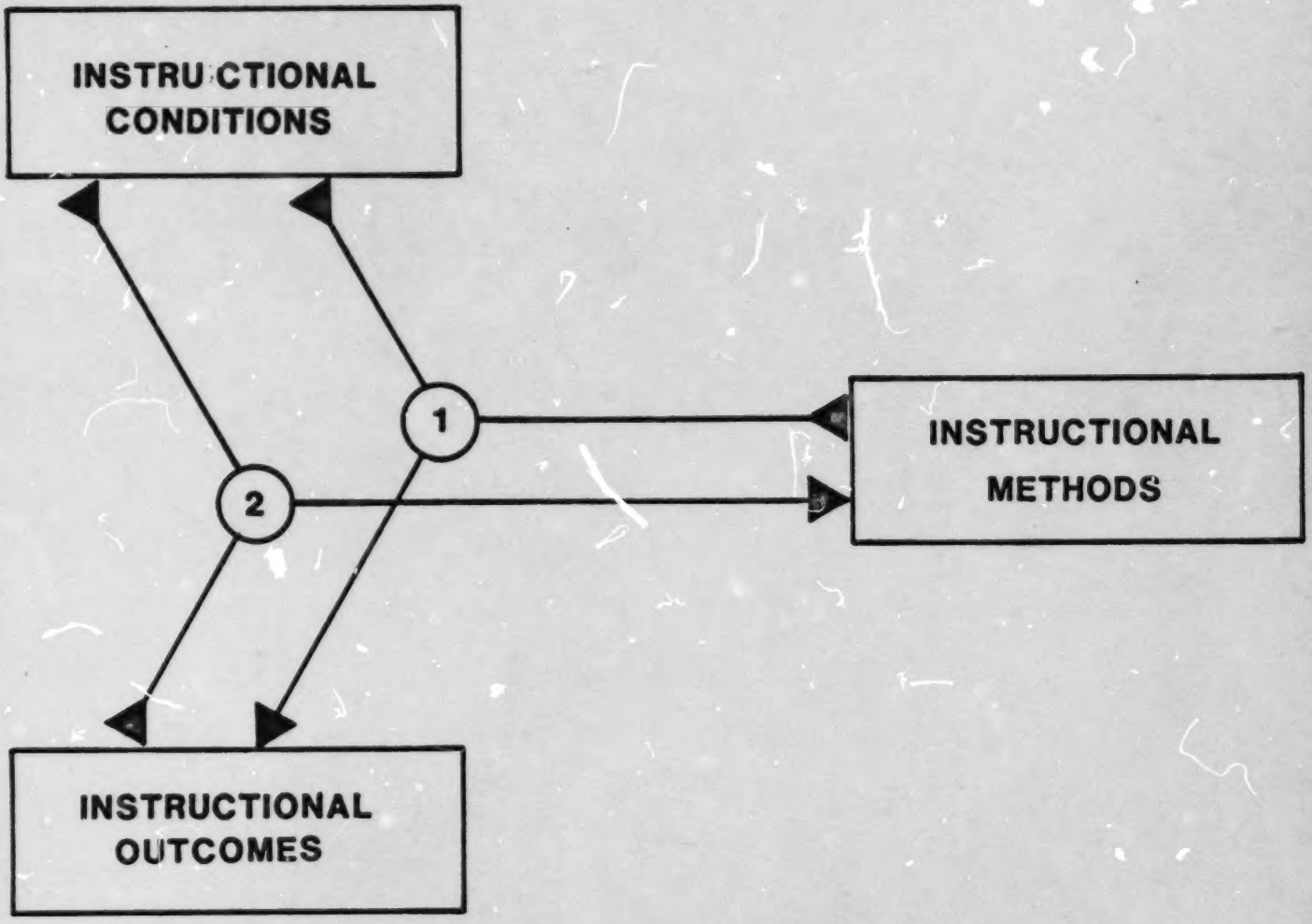

Figure 1 **Three categories of instructional variables, and two sets of interrelationships among those categories.**

Source: From INSTRUCTION-DESIGN THEORIES AND MODELS: AN OVERVIEW OF THEIR CURRENT STATUS, by C.M. Reigeluth. Lawrence Erlbaum, Inc. Hillsdale, New Jersey, c 1983.

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